



# Clean Energy and Pollution Reduction Act Senate Bill 350

## Early Release Material

April 14, 2016



# April 14, 2016 Call Agenda

Time	Topic	Presenter
9:00 – 9:05	Introduction	Kristina Osborne
9:05 – 9:10	Overview	Deb Le Vine
9:10 – 9:30	Brattle: <ul style="list-style-type: none"><li>- Existing Regional Market Studies</li><li>- Production Cost Analysis</li></ul>	Judy Chang Hannes Pfeifenberger
9:30 – 9:50	E3: <ul style="list-style-type: none"><li>- RESOLVE Overview</li><li>- Input Updates</li></ul>	Arne Olsen
9:50 – 10:10	BEAR: <ul style="list-style-type: none"><li>- BEAR and IMPLAN Models</li><li>- Disadvantages Communities</li></ul>	David Roland-Holst
10:10 – 10:30	Aspen: <ul style="list-style-type: none"><li>- Methodology Overview</li><li>- Disadvantaged Communities</li></ul>	Brewster Birdsall Susan Lee
10:30 – 10:40	Next Steps	Deb Le Vine

# CAISO's SB350 Evaluation Plan

## Ratepayer Impact Analysis

PRESENTED TO:

**SB350 CAISO Stakeholder Webinar on Early Release Materials**

PRESENTED BY:

**Judy Chang**

**Hannes Pfeifenberger**

April 14, 2016



THE **Brattle** GROUP

# Summary of Existing Regional Market Studies

The final report will leverage insights from relevant existing studies to inform the analysis and provide bookends to estimated impacts

Study Type	Examples of Studies
<p><b>Day-2 Market Studies</b> Evaluate benefits of moving from de-pancaked transmission + energy imbalance market to full Day-2 market</p>	<p>SPP IM Retrospective (2015), SPP IM Prospective (2009)</p>
<p><b>RTO Participation Studies</b> Evaluate benefits and costs to a utility of joining an existing RTO</p>	<p>PAC-CAISO Integration (2015), WAPA/Basin-SPP (2013), Energy-MISO (2011)</p>
<p><b>Post Order 2000 Studies</b> Benefit-cost studies of forming RTOs that followed issuance of FERC Order 2000 in late 1999</p>	<p>LBNL RTO Study Review (2005), RTO West (2002), National RTO Study (2002)</p>
<p><b>EIM Studies</b> Evaluate the benefits of the Western EIM, or the benefits of a utility joining the EIM</p>	<p>WECC-Wide EIM (2011), APS-EIM (2015), PGE-EIM (2015), NV Energy-EIM (2014), Puget Sound-EIM (2014), PacifiCorp-EIM (2013)</p>
<p><b>European Market Integration Studies</b> Evaluate the benefits of market integration in the European context</p>	<p>EPRG Integrating European Markets (2015), EU Single Market Study (2013)</p>
<p><b>WECC Renewable Integration Studies</b> Studying the challenges of higher penetration of renewable resources</p>	<p>NREL/DOE WWSIS 2 &amp; 3, CEERT/NREL Low Carbon Grid Study, CAISO/GE (stability), WGA least-cost integration</p>

# Findings from Other Market Studies

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- Most market integration studies estimated production cost savings from implementing “Day-2” energy markets across larger regions to be 1-3% of total production costs, including when starting from EIM-type markets
  - Savings associated with unit commitment and day-ahead dispatch (not captured by EIM)
  - Additional savings from managing uncertainties between day-ahead and real-time operations
  - Regional markets lead to better utilization of the existing grid
  - Stronger incentives to increase the efficiency and availability of existing generators (typically not estimated)
- In addition to production cost savings, other savings of larger regional markets include:
  - **Reduced generation capacity** needs and associated investment costs
  - Increased **access to low-cost renewable generation** resources
  - **Reduced cost of balancing** variable renewable generation
- Most prospective studies emphasize their limitations, which tend to not capture certain benefits and underestimate the overall benefits of regional market integration
- Retrospective studies of market integration benefits tend to document higher benefits than those estimated in prospective studies
  - **Production cost savings of 2-8%**, demonstrating limitations of prospective studies
- The SB350 study will be conservative in estimating the benefits of regional markets

# Summary of Assumptions for Production Cost Analysis

## 2020 Analysis:

- Using key assumptions from CEC's 2015 IEPR data
  - California loads, distributed solar, natural gas, and GHG prices
- Wheeling and hurdle rates reflect economic barriers between Balancing Authorities
- Refined representation of future WECC transmission projects
- Refined modeling of pumped storage hydro, and gas CC and CT unit commitment

Inputs	2020 Current Practice	2020 Regional (ISO+PAC)
Renewable portfolio	ISO's Gridview model	<i>Same as Current Practice</i>
Transmission	ISO's Gridview model (removed post-2020 projects)	<i>Same as Current Practice</i>
Load	2015 IEPR	<i>Same as Current Practice</i>
Gas price	2015 IEPR	<i>Same as Current Practice</i>
GHG price	2015 IEPR (\$0 outside of CA)	<i>Same as Current Practice</i>
Reserve requirements	Updated frequency response, LF, and regulation	Allow sharing in ISO+PAC
ISO net export limit	0 MW	776 MW (based on ISO-PAC contract path)
Hurdle rate	Wheeling based on recent tariff; + admin. charges & friction	<i>Same as Current Practice</i>
Contract path	PACE/PACW path not subject to any hurdle rates	ISO-PAC and PACE-PACW paths not subject to any hurdle rates

# Summary of Assumptions for Production Cost Analysis

## 2030 Analysis:

- Growth in loads, distributed solar, and gas prices based on CEC and WECC data
- Added new regional transmission based on TEPPC 2024 Common Case
  - Regional Case 3: Used PacifiCorp’s Gateway D & F to represent generic transmission solution to deliver WY wind
  - Also assume generic transmission solution for NM solar
- Assumed no rest-of-WECC carbon price, but considering a carbon price sensitivity

Inputs	2030 Current Practice	2030 Regional (WECC-PMAs)
Renewable portfolio	Incremental renewables from E3	Incremental renewables from E3
Transmission	ISO’s Gridview model (removed Gateway D & F)	ISO’s Gridview model (assumed WY & NM transmission in Case 3)
Load	2015 IEPR, WECC Load & Resources forecast	<i>Same as Current Practice</i>
Gas price	2015 IEPR	<i>Same as Current Practice</i>
GHG price	2015 IEPR (\$0 outside of CA; sensitivity analysis with same as CA, if time allows)	<i>Same as Current Practice</i>
Reserve requirements	Updated frequency response, load-following, and regulation	Reduce requirements and allow sharing in WECC minus PMAs
ISO net export limit	2,000 or 8,000 MW	8,000 MW
Hurdle rate	Wheeling based on recent tariff; + admin. charges & friction	Removed hurdles within regional footprint





Energy+Environmental Economics

# Portfolio Development + and Data Inputs for ISO SB 350 Study

Arne Olson, Partner





# Overview of the RESOLVE model

- + **RESOLVE is an E3 model that selects least-cost portfolios of renewable resources and integration solutions within the ISO region between 2015 – 2030**
  - Selects portfolio of solar, wind, geothermal, biomass, and small hydro
  - Adds cost-effective integration solutions such as energy storage and flexible conventional resources, in combination with renewable portfolio, to minimize total cost over analysis period
- + **Resources are added to meet RPS target, overbuilding renewable portfolio if necessary**
  - Renewables are curtailed if the output cannot be consumed in California or exported to neighboring systems due to oversupply or insufficient power system flexibility
  - Renewable contracts are treated as sunk costs and fully compensated for curtailed output
  - Resources added to portfolio if necessary to replace curtailed output; Renewable curtailment implicitly valued at replacement cost, which increases geometrically with curtailment



# Updates to Key Input Assumptions Based on Stakeholder Feedback

- + **Updated load forecast to CEC 2015 IEPR mid-AAEE**
  - Load and EVs are lower, Rooftop PV is higher
- + **Statewide analysis rather than exclusive focus on ISO area**
  - Added procurement assumptions for non-ISO areas (LADWP, BANC, TID, IID)
- + **Reduced cost of solar, wind and geothermal resources**
- + **Reduced battery storage costs**
  - Reduced capital cost, adder inverter replacement, increased balance-of-systems costs, reduced fixed O&M, adjusted lifetime
- + **Other**
  - Hydro and storage can provide frequency response

Revised 2030 renewable portfolios will be presented at the next stakeholder workshop based on these changes

# Stakeholder Meeting

## Discussion of Early Release Materials

***David Roland-Holst***  
*Berkeley Economic Advising and Research*  
[dwrh@bearecon.com](mailto:dwrh@bearecon.com)

***14 April 2016***



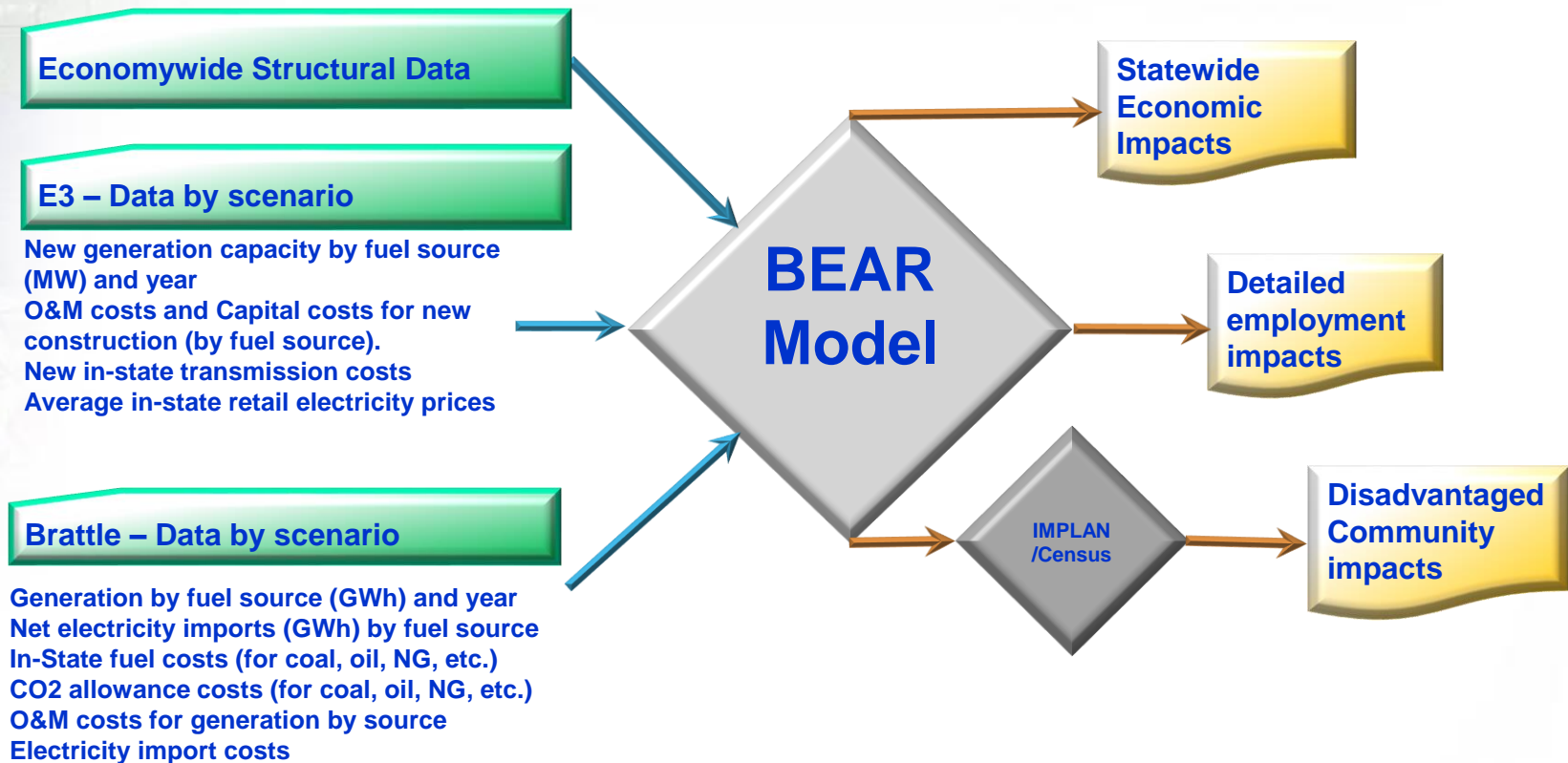
**Berkeley Economic Advising and Research**  
[www.bearecon.com](http://www.bearecon.com)



# A Few Economic Principles

1. Infrastructure investment can create short-term employment.
2. Capacity investment can create short and long term jobs, depending on import content.
3. Expenditure Shifting: Demand funded by energy savings is long term, creates more jobs, more kinds of jobs, and is more likely to be for California goods and services.
4. More affordable energy is pro-poor: Lower income households spend a larger percent of their income on energy services.

# Economic Assessment Framework



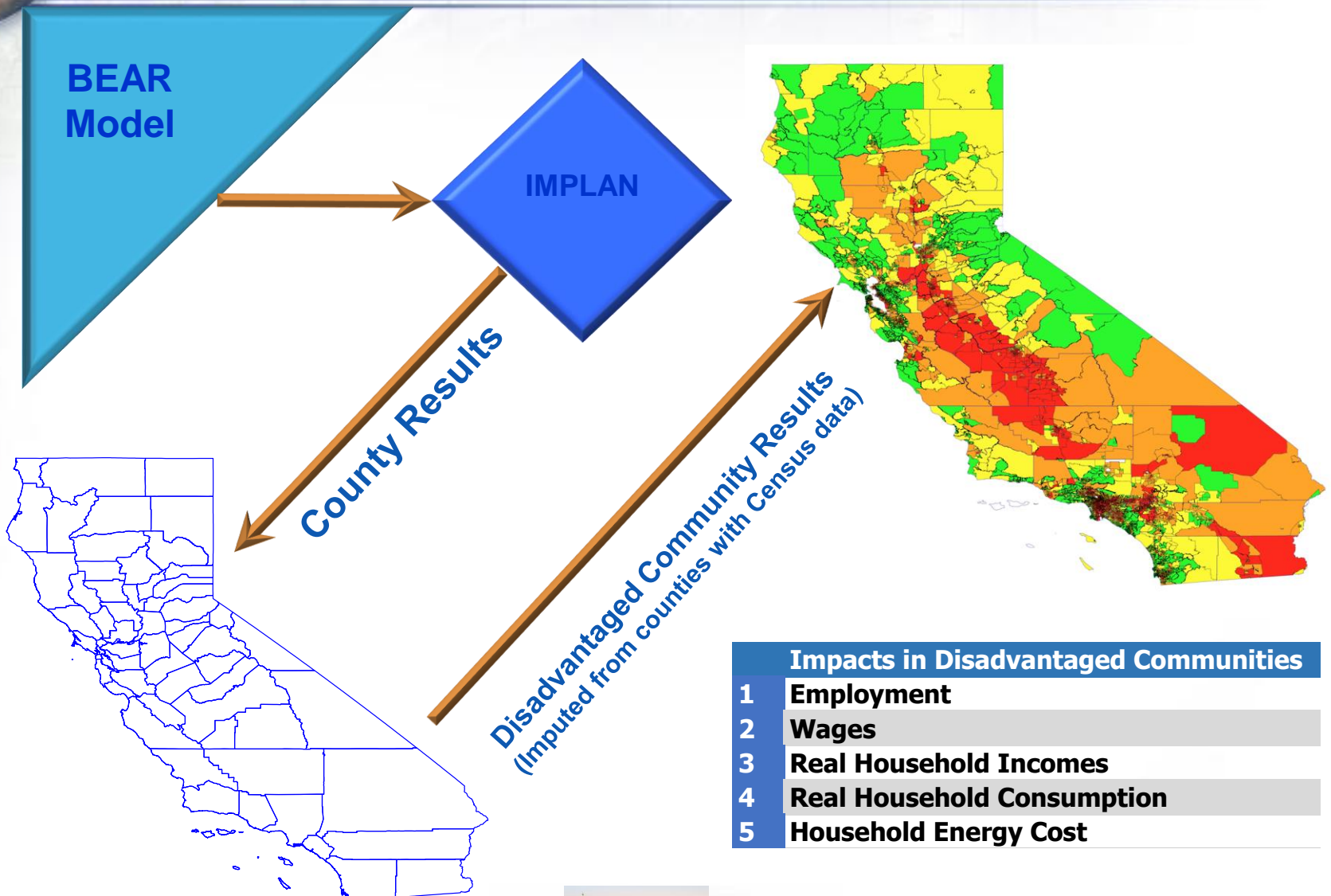


# BEAR Macroeconomic Impacts

Category	Output
Employment	Aggregate
	Sector
	Households by Income Decile
	Labor category (skilled, unskilled)
Gross state product	Aggregate
	Sector
Personal income	Household ratepayer by income decile
	Labor category
Enterprise Income	Firm ratepayers by sector
State tax revenue	Aggregate



# Detailed Livelihoods Impacts



Impacts in Disadvantaged Communities	
1	Employment
2	Wages
3	Real Household Incomes
4	Real Household Consumption
5	Household Energy Cost



# Economic Assessment - Summary

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- Objective – to promote evidence-based energy policy dialog
- Overview of income and job dynamics
- Economic Model, Data, and Scenarios
- Stakeholder Inputs
  - Data sources and perspectives
  - Subjects and issues of emphasis
  - Assumptions

# **SB 350 Environmental Study Methodology Overview**

For stakeholder call: April 14, 2016

# Technical Material Included

## Contents of Methodology Overview:

- Environmental Study Approach
- Description of Study Zones
- Baseline Conditions and Indicators of Impacts
- How Topics would be Analyzed

# Technical Material Included

## Screening for Disadvantaged Communities

- Census tract scores from CalEnviroScreen 2.0 results
- 25% highest-scoring census tracts, mapped as disadvantaged communities
- Distributed per County, Air Basin, and certain CREZs

## Next steps

- April 27 – 28, 2016 stakeholder meeting on preliminary results
- May 13, 2016 – stakeholder comments due to ISO

### **Additional reference materials:**

Senate Bill No. 350 - Clean Energy and Pollution Reduction Act of 2015

[https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB350](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB350)

Fast Facts – Benefits of a regional energy market

<http://www.caiso.com/Documents/2015RegionalBenefitsFactSheet.pdf>

Early release material

<http://www.caiso.com/informed/Pages/RegionalEnergyMarket/BenefitsofaRegionalEnergyMarket.aspx>